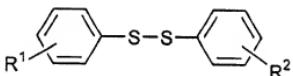


WHAT IS CLAIMED IS:

5        1. A non-aqueous secondary battery which comprises  
a positive electrode, a negative electrode, a separator,  
and an electrolytic solution which contains a substituted  
diphenyldisulfide derivative having the formula:



15        wherein each of R¹ and R² independently represents an  
alkoxy group having 1 to 6 carbon atoms, an alkenyloxy  
group having 2 to 6 carbon atoms, an alkynyoxy group  
having 2 to 6 carbon atoms, a cycloalkyloxy having 3 to 6  
carbon atoms, an aryloxy group having 6 to 12 carbon  
atoms, an acyloxy group having 2 to 7 carbon atoms, an  
alkanesulfonyloxy group having 1 to 7 carbon atoms, an  
20        arylsulfonyloxy group having 6 to 10 carbon atoms, an  
alkoxycarbonyloxy group having 2 to 7 carbon atoms, an  
aryloxycarbonyloxy group having 7 to 13 carbon atoms, a  
halogen atom, CF<sub>3</sub>, CCl<sub>3</sub>, or CBr<sub>3</sub>,  
in an amount of 0.01 to 5 weight % based on the amount of  
25        the electrolytic solution.

30        2. The non-aqueous secondary battery of claim 1,  
in which each of R¹ and R² is an alkoxy group having 1 to  
6 carbon atoms.

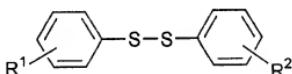
35        3. The non-aqueous secondary battery of claim 1,  
wherein the substituted diphenyldisulfide derivative is  
contained in the non-aqueous electrolytic solution in an  
amount of 0.01 to 2 weight % based on the amount of the  
electrolytic solution.

4. The non-aqueous secondary battery of claim 1, wherein the positive electrode comprises lithium complex oxide.

5 5. The non-aqueous secondary battery of claim 1, wherein the negative electrode comprises natural graphite or artificial graphite.

10 6. The non-aqueous secondary battery of claim 5, wherein the natural or artificial graphite has a lattice plane of (002) having a plane distance in term of  $d_{002}$  in a length of 0.335 to 0.340 nm.

15 7. A non-aqueous electrolytic solution containing a substituted diphenyldisulfide derivative having the following formula:



20

wherein each of R<sup>1</sup> and R<sup>2</sup> independently represents an alkoxy group having 1 to 6 carbon atoms, an alkenyloxy group having 2 to 6 carbon atoms, an alkynyoxy group having 2 to 6 carbon atoms, a cycloalkyloxy having 3 to 6 carbon atoms, an aryloxy group, an acyloxy group having 2 to 7 carbon atoms, an alkanesulfonyloxy group having 1 to 7 carbon atoms, an arylsulfonyloxy group having 6 to 10 carbon atoms, an alkoxy carbonyloxy group having 2 to 7 carbon atoms, an aryloxycarbonyloxy group, a halogen atom, CF<sub>3</sub>, CCl<sub>3</sub>, or CBr<sub>3</sub>, in an amount of 0.01 to 5 weight % based on the amount of the electrolytic solution.

35 8. The non-aqueous electrolytic solution of claim 7, in which each of R<sup>1</sup> and R<sup>2</sup> is an alkoxy group having 1 to 6 carbon atoms.

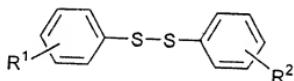
9. The non-aqueous electrolytic solution of claim 7 in which the substituted diphenyldisulfide derivative is bis(4-methoxyphenyl)disulfide.

5       10. The non-aqueous electrolytic solution of claim 7, wherein the substituted diphenyldisulfide derivative is contained in the non-aqueous electrolytic solution in an amount of 0.01 to 2 weight % based on the amount of the electrolytic solution.

10      11. The non-aqueous electrolytic solution of claim 7, which contains LiPF<sub>6</sub>, LiBF<sub>4</sub>, LiClO<sub>4</sub>, LiN(SO<sub>2</sub>CF<sub>3</sub>)<sub>2</sub>, LiN(SO<sub>2</sub>C<sub>2</sub>F<sub>5</sub>)<sub>2</sub>, LiC(SO<sub>2</sub>CF<sub>3</sub>)<sub>3</sub>, LiPF<sub>4</sub>(CF<sub>3</sub>)<sub>2</sub>, LiPF<sub>3</sub>(CF<sub>3</sub>)<sub>3</sub>, LiPF<sub>3</sub>(C<sub>2</sub>F<sub>5</sub>)<sub>3</sub>, LiPF<sub>5</sub>(iso-C<sub>3</sub>F<sub>7</sub>), or LiPF<sub>4</sub>(iso-C<sub>3</sub>F<sub>7</sub>)<sub>2</sub>.

15      12. The non-aqueous electrolytic solution of claim 7, which contains a solvent selected from the group consisting of ethylene carbonate, propylene carbonate, butylene carbonate, vinylene carbonate, dimethyl carbonate, methyl ethyl carbonate, methyl isopropyl carbonate, methyl isobutyl carbonate, diethyl carbonate, diisopropyl carbonate, diisobutyl carbonatetetrahydrofuran, 2-methyltetrahydrofuran, 1,4-dioxane, 1,2-dimethoxyethane, 1,2-diethoxyethane, 1,2-dibutoxyethane,  $\gamma$ -butyrolactone, acetonitrile, methyl propionate, and dimethylformamide.

20      13. A non-aqueous secondary battery which comprises a positive electrode, a negative electrode, a separator, and an electrolytic solution which contains a substituted diphenyldisulfide derivative having the formula:



wherein each of R<sup>1</sup> and R<sup>2</sup> independently represents an alkoxy group having 1 to 6 carbon atoms, an alkenyloxy group having 2 to 6 carbon atoms, an alkynyloxy group having 2 to 6 carbon atoms, a cycloalkyloxy having 3 to 6

5 carbon atoms, an aryloxy group having 6 to 12 carbon atoms, an aralkyloxy group having 7 to 15 carbon atoms, an acyloxy group having 2 to 7 carbon atoms, an alkane-sulfonyloxy group having 1 to 7 carbon atoms, an arylsulfonyloxy group having 6 to 10 carbon atoms, an alkoxy-  
10 carbonyloxy group having 2 to 7 carbon atoms, a halogen atom, CF<sub>3</sub>, CCl<sub>3</sub>, or CBr<sub>3</sub>,

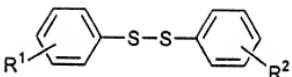
in an amount of 0.001 to 5 weight % based on the amount of the electrolytic solution, and an additive compound selected from the group consisting of methyl 2-propyl-carbonate, 2-propynyl methanesulfonate, 1,3-propanesulfone, divinylsulfone, and 1,4-butanediol dimethanesulfonate, in an amount of 0.01 to 10 weight % based on the amount of the electrolytic solution.

20 14. The non-aqueous secondary battery of claim 13, in which each of R<sup>1</sup> and R<sup>2</sup> is an alkoxy group having 1 to 6 carbon atoms.

25 15. The non-aqueous secondary battery of claim 13, wherein the negative electrode comprises natural graphite or artificial graphite.

30 16. The non-aqueous secondary battery of claim 15, wherein the natural or artificial graphite has a lattice plane of (002) having a plane distance in term of d<sub>002</sub> in a length of 0.335 to 0.340 nm.

35 17. A non-aqueous electrolytic solution containing a substituted diphenyldisulfide derivative having the following formula:



5 wherein each of R<sup>1</sup> and R<sup>2</sup> independently represents an  
alkoxy group having 1 to 6 carbon atoms, an alkenyloxy  
group having 2 to 6 carbon atoms, an alkynyloxy group  
having 2 to 6 carbon atoms, a cycloalkyloxy having 3 to 6  
10 carbon atoms, an aryloxy group having 6 to 12 carbon  
atoms, an aralkyloxy group having 7 to 15 carbon atoms,  
an acyloxy group having 2 to 7 carbon atoms, an alkane-  
sulfonyloxy group having 1 to 7 carbon atoms, an arylsul-  
fonyloxy group having 6 to 10 carbon atoms, an alkoxy-  
15 carbonyloxy group having 2 to 7 carbon atoms, a halogen  
atom, CF<sub>3</sub>, CCl<sub>3</sub>, or CBr<sub>3</sub>,  
in an amount of 0.001 to 5 weight % based on the amount  
of the electrolytic solution, and an additive compound  
selected from the group consisting of methyl 2-propyl-  
20 carbonate, 2-propynyl methanesulfonate, 1,3-propanesul-  
tone, divinylsulfone, and 1,4-butanediol dimethanesul-  
fonate, in an amount of 0.01 to 10 weight % based on the  
amount of the electrolytic solution.

25 18. The non-aqueous electrolytic solution of claim  
17, in which each of R<sup>1</sup> and R<sup>2</sup> is an alkoxy group having 1  
to 6 carbon atoms.

30 19. The non-aqueous electrolytic solution of claim  
17 in which the substituted diphenyldisulfide derivative  
is bis(4-methoxyphenyl)disulfide.

35 20. The non-aqueous electrolytic solution of claim  
17, wherein the substituted diphenyldisulfide derivative  
is contained in the non-aqueous electrolytic solution in  
an amount of 0.01 to 0.7 weight % based on the amount of

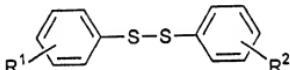
the electrolytic solution.

21. The non-aqueous electrolytic solution of claim  
17, wherein the additive is contained in the non-aqueous  
5 electrolytic solution in an amount of 0.05 to 5 weight %  
based on the amount of the electrolytic solution.

22. The non-aqueous electrolytic solution of claim  
17, which contains LiPF<sub>6</sub>, LiBF<sub>4</sub>, LiClO<sub>4</sub>, LiN(SO<sub>2</sub>CF<sub>3</sub>)<sub>2</sub>,  
10 LiN(SO<sub>2</sub>C<sub>2</sub>F<sub>5</sub>)<sub>2</sub>, LiC(SO<sub>2</sub>CF<sub>3</sub>)<sub>3</sub>, LiPF<sub>4</sub>(CF<sub>3</sub>)<sub>2</sub>, LiPF<sub>3</sub>(CF<sub>3</sub>)<sub>3</sub>,  
LiPF<sub>3</sub>(C<sub>2</sub>F<sub>5</sub>)<sub>3</sub>, LiPF<sub>5</sub>(iso-C<sub>3</sub>F<sub>7</sub>), or LiPF<sub>4</sub>(iso-C<sub>3</sub>F<sub>7</sub>)<sub>2</sub>.

23. The non-aqueous electrolytic solution of claim  
17, which contains a solvent selected from the group con-  
15 sisting of ethylene carbonate, propylene carbonate,  
butylene carbonate, vinylene carbonate, dimethyl carbon-  
ate, methyl ethyl carbonate, methyl isopropyl carbonate,  
methyl isobutyl carbonate, diethyl carbonate, diisopropyl  
carbonate, diisobutyl carbonatetetrahydrofuran, 2-methyl-  
20 tetrahydrofuran, 1,4-dioxane, 1,2-dimethoxyethane, 1,2-  
diethoxyethane, 1,2-dibutoxyethane, γ-butyrolactone, ace-  
tonitrile, methyl propionate, and dimethylformamide.

24. A non-aqueous secondary battery which comprises  
25 a positive electrode, a negative electrode, a separator,  
and an electrolytic solution which contains a substituted  
diphenyldisulfide derivative having the formula:



35 wherein each of R<sup>1</sup> and R<sup>2</sup> independently represents an  
alkoxy group having 1 to 6 carbon atoms, an alkenyloxy  
group having 2 to 6 carbon atoms, an alkynyoxy group  
having 2 to 6 carbon atoms, a cycloalkyloxy having 3 to 6

10002130 - 102202

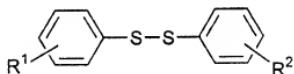
carbon atoms, an aryloxy group having 6 to 12 carbon atoms, an aralkyloxy group having 7 to 15 carbon atoms, an acyloxy group having 2 to 7 carbon atoms, an alkane-sulfonyloxy group having 1 to 7 carbon atoms, an arylsulfonyloxy group having 6 to 10 carbon atoms, an alkoxy-carbonyloxy group having 2 to 7 carbon atoms, a halogen atom,  $\text{CF}_3$ ,  $\text{CCl}_3$ , or  $\text{CBr}_3$ ,  
5 in an amount of 0.001 to 5 weight % based on the amount of the electrolytic solution, and cyclohexylbenzene in an  
10 amount of 0.1 to 5 weight % based on the amount of the electrolytic solution.

25. The non-aqueous secondary battery of claim 24,  
in which each of R<sup>1</sup> and R<sup>2</sup> is an alkoxy group having 1 to  
15 24 carbon atoms.

26. The non-aqueous secondary battery of claim 24, wherein the negative electrode comprises natural graphite or artificial graphite.

27. The non-aqueous secondary battery of claim 26, wherein the natural or artificial graphite has a lattice plane of (002) having a plane distance in term of  $d_{002}$  in a length of 0.335 to 0.340 nm.

28. A non-aqueous electrolytic solution containing a substituted diphenyldisulfide derivative having the following formula:



wherein each of R<sup>1</sup> and R<sup>2</sup> independently represents an alkoxy group having 1 to 6 carbon atoms, an alkenyloxy group having 2 to 6 carbon atoms, an alkynyoxy group

having 2 to 6 carbon atoms, a cycloalkyloxy having 3 to 6 carbon atoms, an aryloxy group having 6 to 12 carbon atoms, an aralkyloxy group having 7 to 15 carbon atoms, an acyloxy group having 2 to 7 carbon atoms, an alkane-

5 sulfonyloxy group having 1 to 7 carbon atoms, an arylsulfonyloxy group having 6 to 10 carbon atoms, an alkoxy-carbonyloxy group having 2 to 7 carbon atoms, a halogen atom, CF<sub>3</sub>, CCl<sub>3</sub>, or CBr<sub>3</sub>,

10 in an amount of 0.001 to 5 weight % based on the amount of the electrolytic solution, and cyclohexylbenzene in an amount of 0.1 to 5 weight % based on the amount of the electrolytic solution.

15 29. The non-aqueous electrolytic solution of claim 28, in which each of R<sup>1</sup> and R<sup>2</sup> is an alkoxy group having 1 to 6 carbon atoms.

20 30. The non-aqueous electrolytic solution of claim 28 in which the substituted diphenyldisulfide derivative is bis(4-methoxyphenyl)disulfide.

25 31. The non-aqueous electrolytic solution of claim 28, wherein the substituted diphenyldisulfide derivative is contained in the non-aqueous electrolytic solution in an amount of 0.01 to 0.7 weight % based on the amount of the electrolytic solution.

30 32. The non-aqueous electrolytic solution of claim 28, wherein the cyclohexylbenzene is contained in the non-aqueous electrolytic solution in an amount of 0.5 to 3 weight % based on the amount of the electrolytic solution.

35 33. The non-aqueous electrolytic solution of claim 28, which contains LiPF<sub>6</sub>, LiBF<sub>4</sub>, LiClO<sub>4</sub>, LiN(SO<sub>2</sub>CF<sub>3</sub>)<sub>2</sub>, LiN(SO<sub>2</sub>C<sub>2</sub>F<sub>5</sub>)<sub>2</sub>, LiC(SO<sub>2</sub>CF<sub>3</sub>)<sub>3</sub>, LiPF<sub>4</sub>(CF<sub>3</sub>)<sub>2</sub>, LiPF<sub>3</sub>(CF<sub>3</sub>)<sub>3</sub>,

102201-120-002201

LiPF3(C2F5)3, LiPF5(iso-C3F7), or LiPF4(iso-C3F7)2.

34. The non-aqueous electrolytic solution of claim  
28, which contains a solvent selected from the group con-  
5 sisting of ethylene carbonate, propylene carbonate,  
butylene carbonate, vinylene carbonate, dimethyl carbon-  
ate, methyl ethyl carbonate, methyl isopropyl carbonate,  
methyl isobutyl carbonate, diethyl carbonate, diisopropyl  
10 carbonate, diisobutyl carbonatetetrahydrofuran, 2-methyl-  
tetrahydrofuran, 1,4-dioxane, 1,2-dimethoxyethane, 1,2-  
diethoxyethane, 1,2-dibutoxyethane,  $\gamma$ -butyrolactone, ace-  
tonitrile, methyl propionate, and dimethylformamide.

15

10021130.102201